Maine GEO Environment & Wildlife Working Group
High Abundance Areas

Location	Marine life with particularly high abundance
Nearshore areas	**Cetaceans:** North Atlantic right whale, fin, sei, humpback; October – February (high uncertainty) **Seabirds:** nesting seabirds, species that use the Northeast for breeding, feeding, and are resident species; surface-feeding seabirds **Fish:** demersal and forage species, spring and fall **Other:** deep sea soft coral suitable habitat
Great South Channel	**Cetaceans:** North Atlantic right whale, fin, sei, humpback; January and February (higher uncertainty in January) **Seabirds:** species that use the Northeast for feeding **Fish:** demersal species in fall; forage species in spring
Northern edge of George's Bank	**Cetaceans:** North Atlantic right whale, fin, sei, humpback; October, January, February (high uncertainty) **Seabirds:** species that use the Northeast for feeding, surface-feeding seabirds **Fish:** demersal species in fall **Other:** deep sea soft and stony corals suitable habitat
Cashes Ledge	**Cetaceans:** North Atlantic right whale, fin, sei, humpback; October – February **Seabirds:** species that use the Northeast for feeding, surface-feeding seabirds **Fish:** demersal species in fall and spring **Other:** deep sea stony coral suitable habitat
Platts Bank	**Cetaceans:** North Atlantic right whale, fin, sei, humpback; October – December **Seabirds:** Northeast resident species and species that use the Northeast for breeding **Fish:** forage fish in spring and fall **Other:** deep sea stony coral suitable habitat

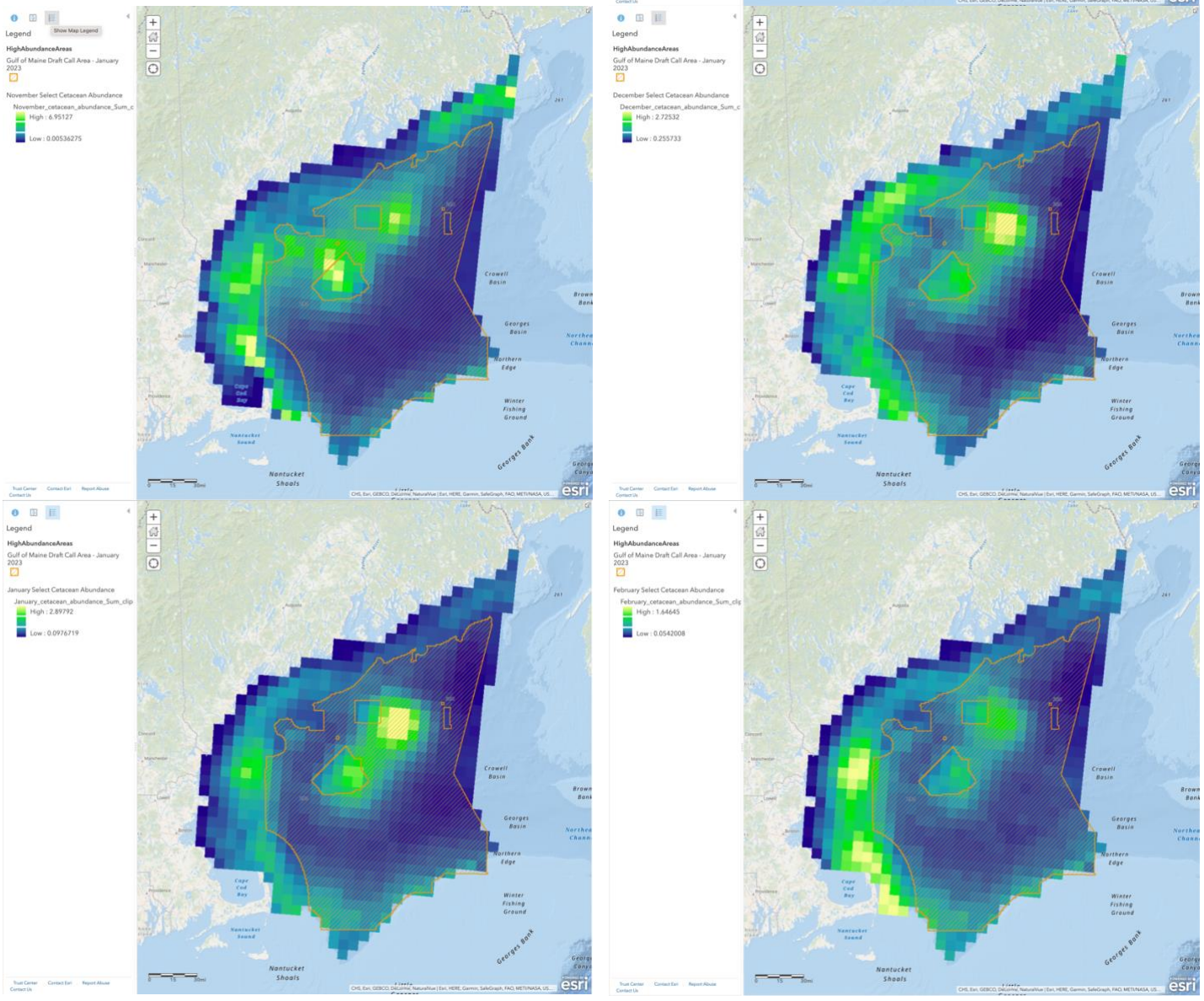
Caveats and uncertainty

- High abundance areas do not, by definition, accurately represent areas that may be important for animal passage between high abundance areas, migration routes, or other life history events where animals occur in lower densities
- Companion layers representing various forms of model uncertainty (e.g., coefficient of variation, estimates of survey effort) are available for most products and are critical for interpreting patterns in the data; encourage caution when considering areas with high uncertainty for potential new uses
- Areas with high uncertainty and/or low survey effort may have high abundance
- Cetacean and seabird species distribution, abundance, and behavior may not be represented accurately in the model outputs which are limited to visual survey data inputs; datasets derived from additional survey types are provided as validation of high abundance areas (Map pages 6, 7, 13).
- NOAA NMFS trawl survey data target demersal species but are not a good representation of forage species biomass (the data are likely a better indicator of locations of forage species presence) (Map page 14)
- The areas with the highest certainty in the cetacean models are in the center of the Gulf of Maine, overlapping with the bulk of the Draft Call Area (Map page 4)
- Seabird survey effort in the Gulf of Maine is patchy but appears to be focused in areas where seabirds spend the most time (Map page 8-13); model outputs reflect places where many species spend the most time – banks, shoals, and inshore waters where they can access food. Other important life-history areas (nesting, breeding) are not represented well in the models but multiple data sources can be used to estimate areas of importance (Map page 10)

Total abundance of four cetacean species in the Gulf of Maine from October (top right) through February (bottom-most right)

- North Atlantic right whale
- Fin whale
- Sei whale
- Humpback whale

Cetacean model outputs (Roberts et al. 2021) were clipped to the Gulf of Maine; Model outputs reflect the predicted density for each month using observations from 2010-2018 for NARW and 1992-2016 for other species; Each panel's color scale is independent; Low to high abundance is scaled dark blue to yellow; note approximately 3x higher abundance values in October and November



Areas of high cetacean model uncertainty (coefficient of Variation, CV of monthly total abundance) for four cetacean species in the Gulf of Maine

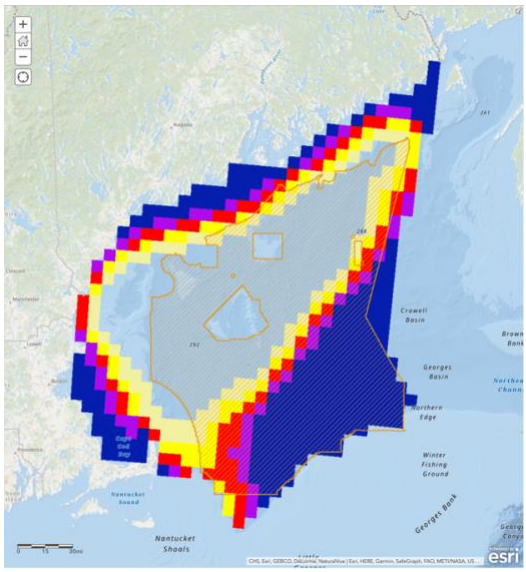
- North Atlantic right whale
- Fin whale
- Sei whale
- Humpback whale

The CV is the ratio of the model's estimate of standard error to predicted average density. Values greater than 1, indicate areas where the predicted average density may differ substantially from the true average density. In areas where true density is very low, it can be hard for the model to estimate precisely how low, and CV may be high.

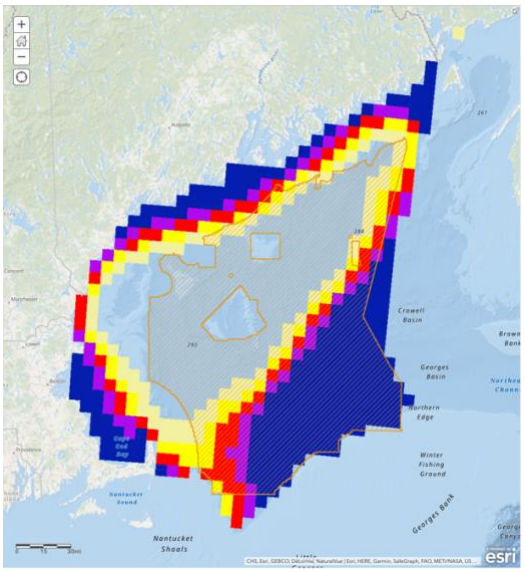
CV Value

- 1.0 - 1.26
- 1.26 - 1.5
- 1.5 - 1.75
- 1.75 - 2.0
- > 2.0

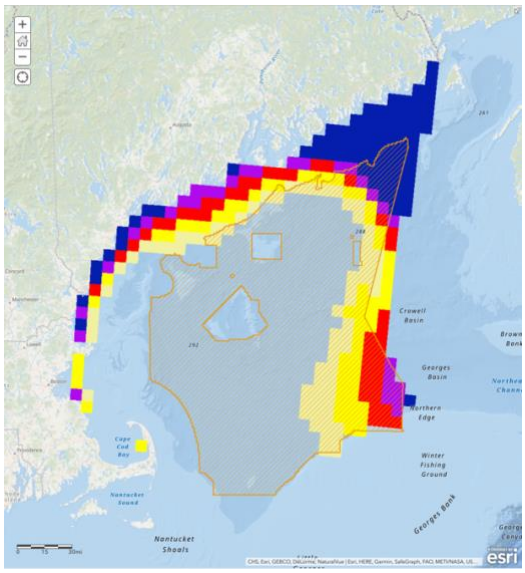
October CV



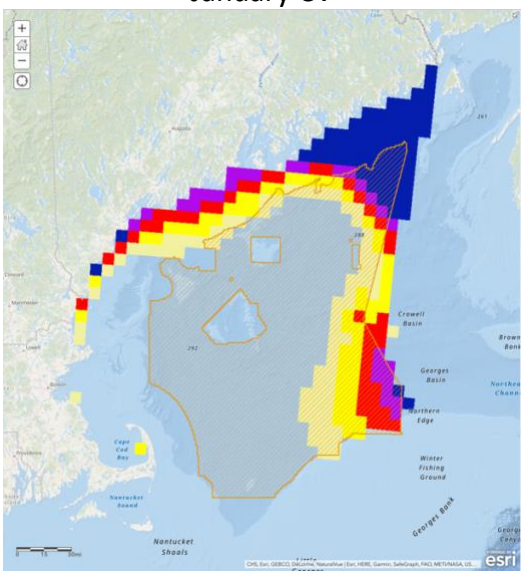
November CV



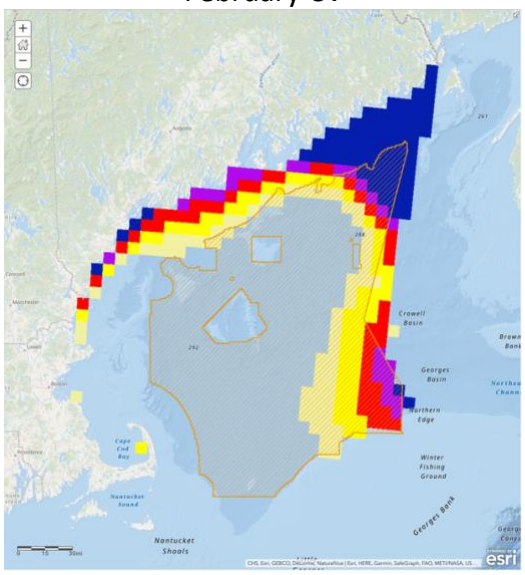
December CV



January CV



February CV



Areas of high cetacean abundance with uncertainty overlay in the Gulf of Maine from Oct. – Feb. derived from the model outputs on Map page 3

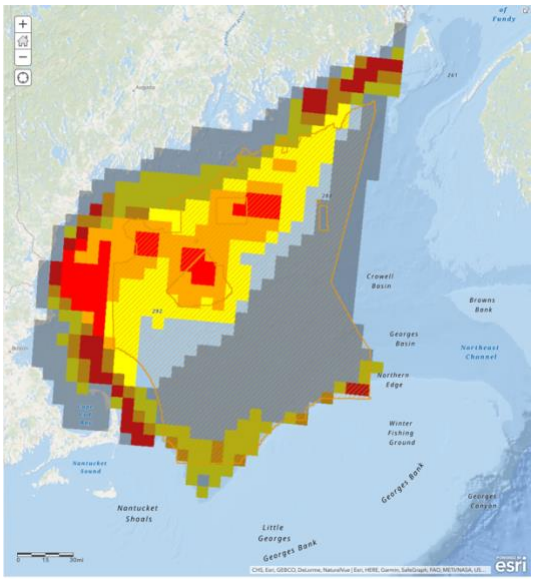
- North Atlantic right whale
- Fin whale
- Sei whale
- Humpback whale

Colored pixels show percentile thresholds of high cetacean abundance:

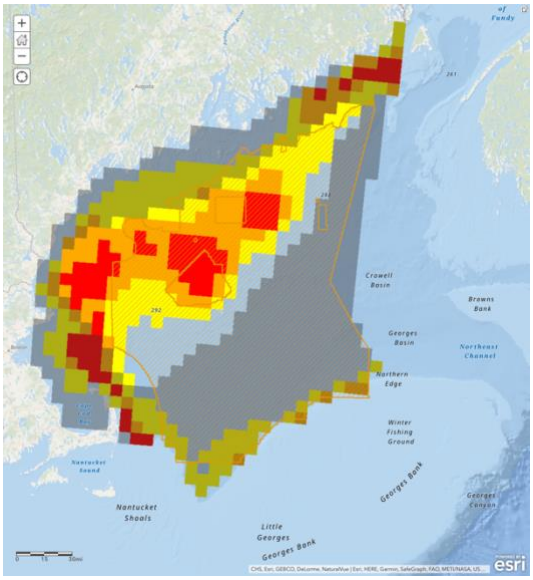
- 50th percentile
- 75th percentile
- 90th percentile

Dark grey transparent overlay represents areas with higher uncertainty from layers on Map page 4

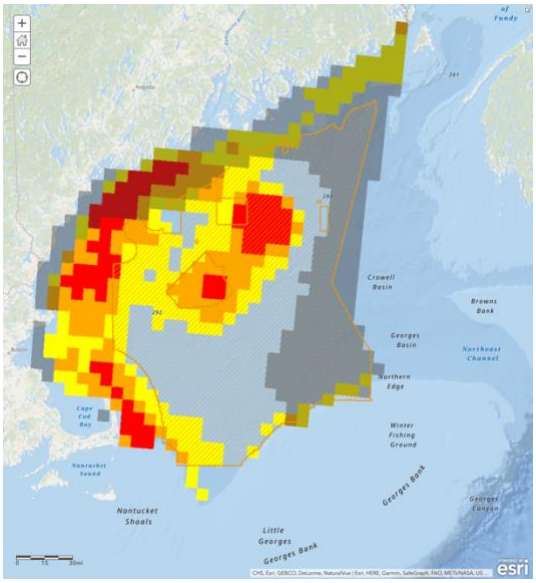
October



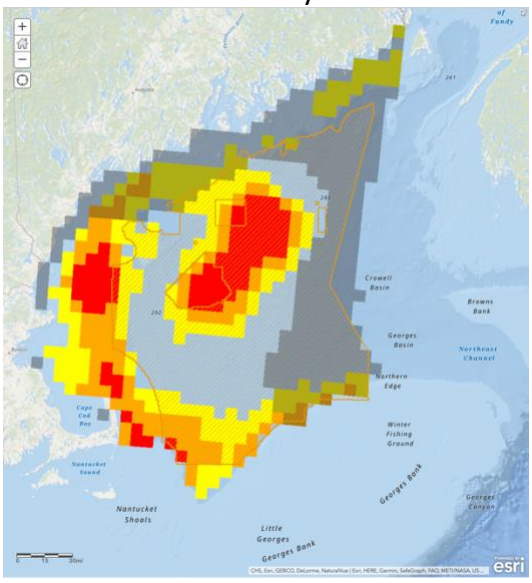
November



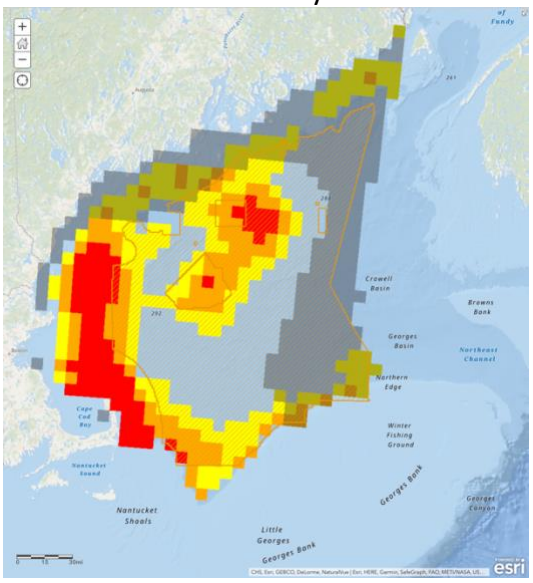
December



January



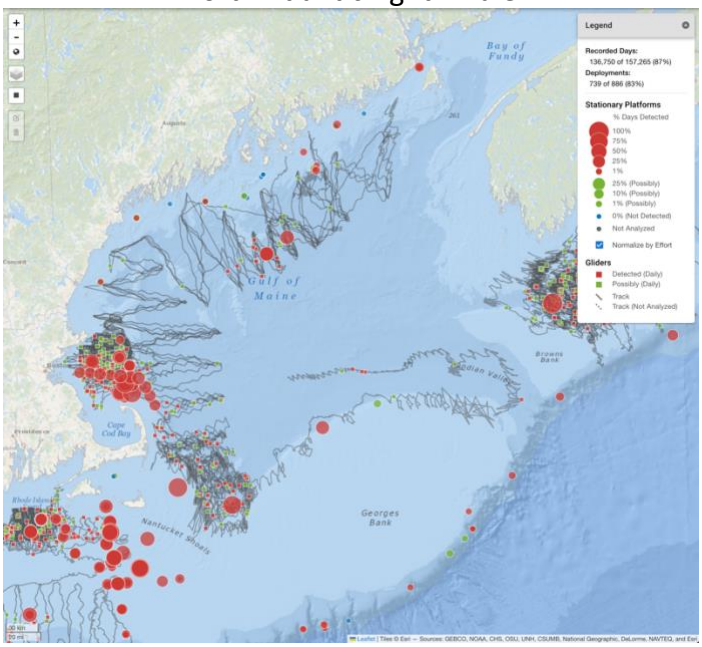
February



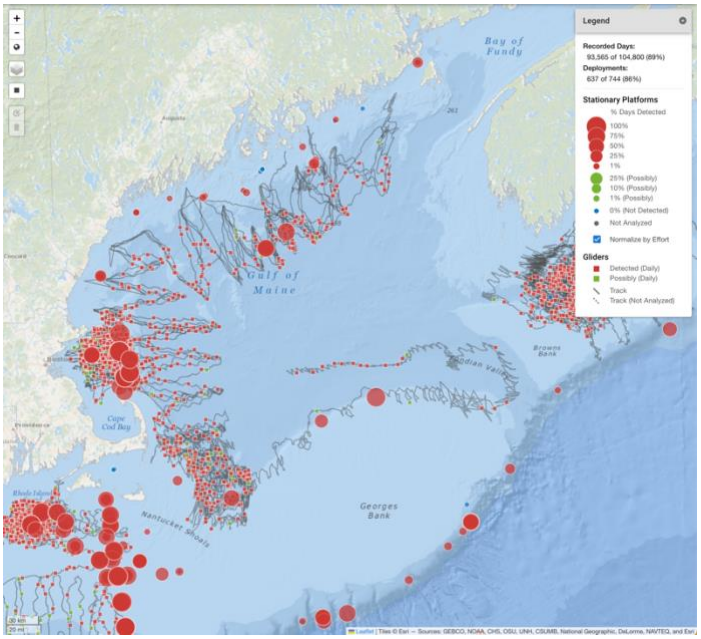
Passive acoustic detections of baleen whales from 2010-2022

- Normalized by effort
- Passive Acoustic Cetacean Map https://apps-nefsc.fisheries.noaa.gov/pacm

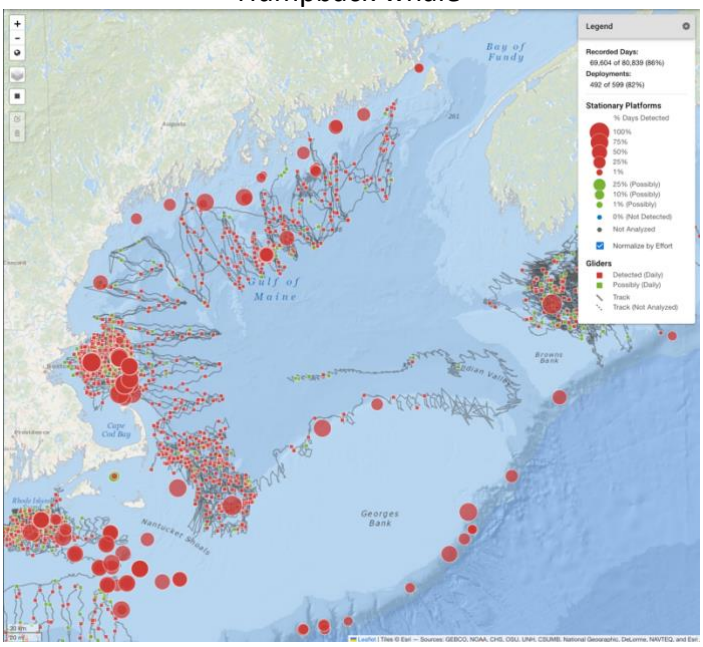
North Atlantic right whale



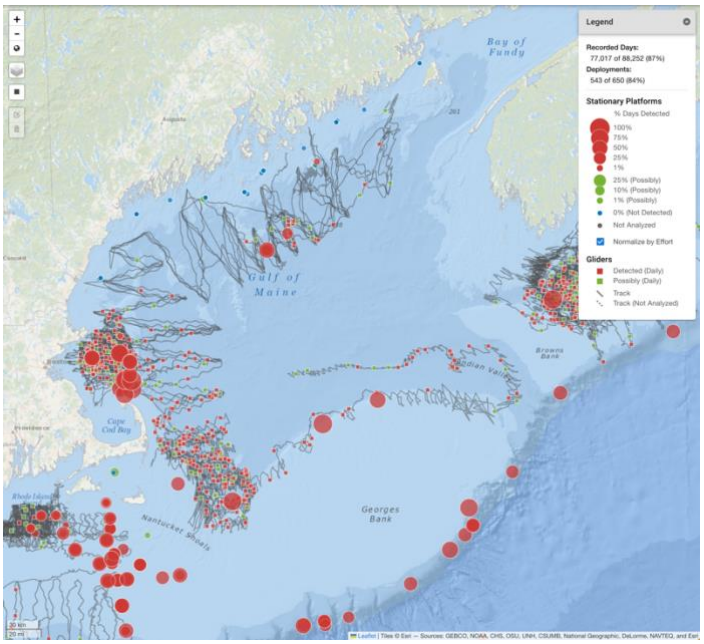
Fin whale



Humpback whale



Sei whale

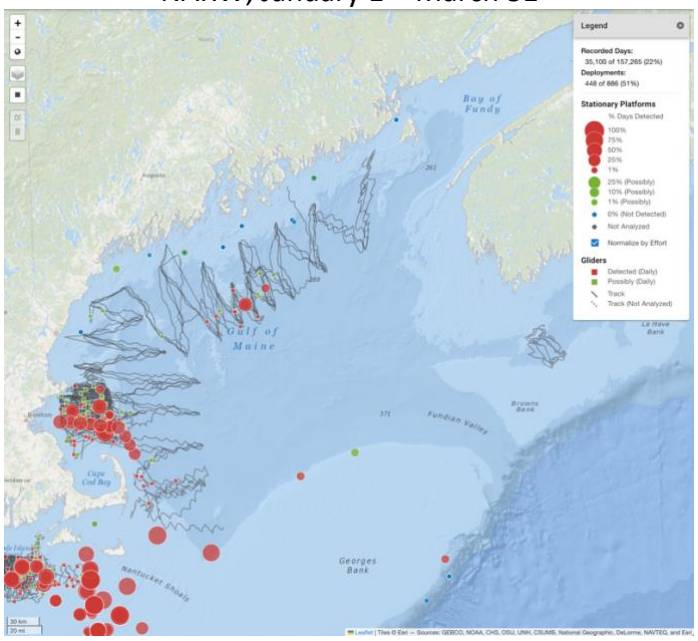


Passive acoustic detections of North Atlantic right whales (NARW) from 2010-2022 for each season

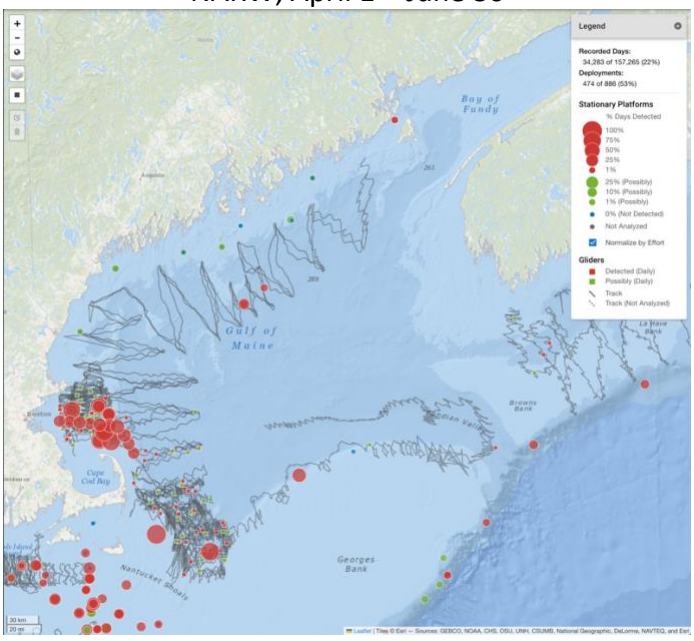
- Normalized by effort

- From Passive Acoustic Cetacean Map https://apps-nefsc.fisheries.noaa.gov/pacm

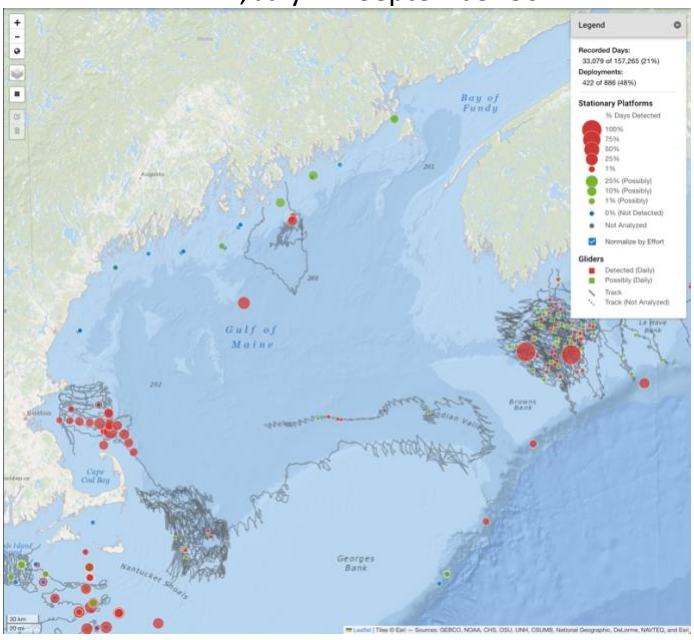
NARW, January 1 – March 31



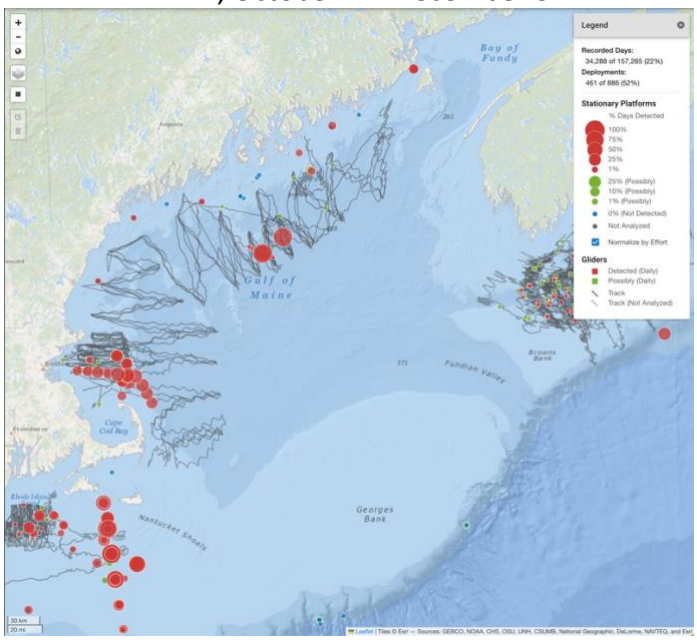
NARW, April 1 – June 30



NARW, July 1 – September 30

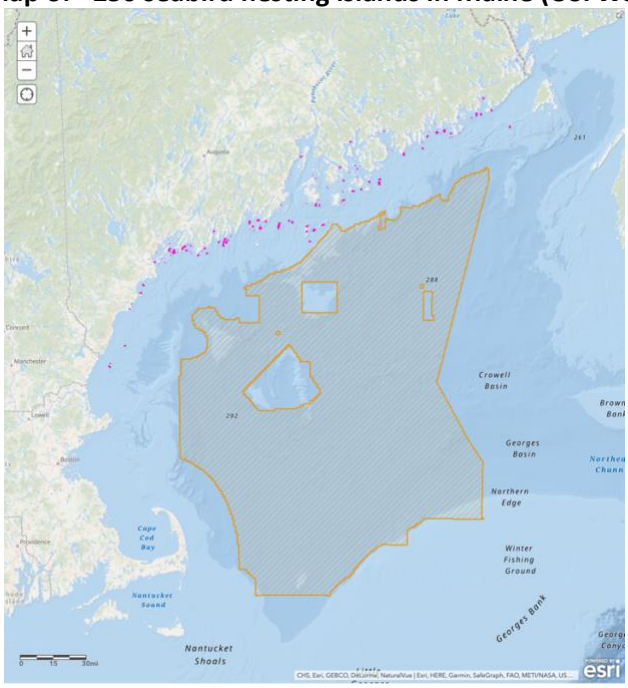


NARW, October 1 – December 31



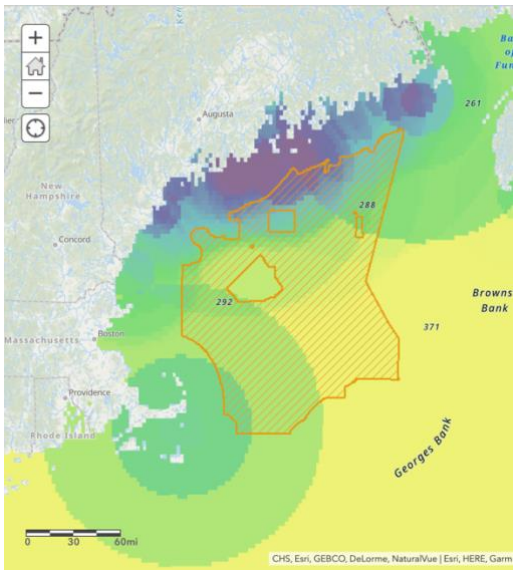
Seabird nesting, breeding, and foraging

Map of >250 seabird nesting islands in Maine (USFWS)



Foraging areas for 14 species of nesting marine birds

Stepanuk, J.; Adams, E.; Dodgin, S.; Gilbert, A.; Goodale, W.; Jenkins, E.2022. Supporting offshore wind siting in the Gulf of Maine–Marine birds. Report to the Maine Department of Inland Fisheries and Wildlife. Biodiversity Research Institute, Portland, ME. 52pp.



Number of overlapping forage areas:

High

Low

Total relative abundance of seabird species in the Gulf of Maine that use the Northeast for breeding

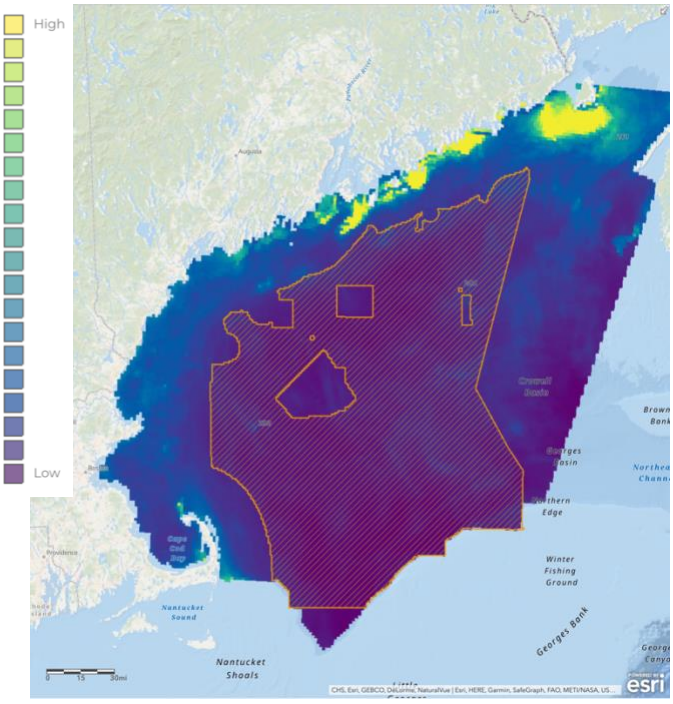
Atlantic puffin*; Black guillemot; Common eider; Common loon; Common tern; Double-crested cormorant; Great black-backed gull; Herring gull; Laughing gull; Leach's storm petrel; Razorbill*; Roseate tern**

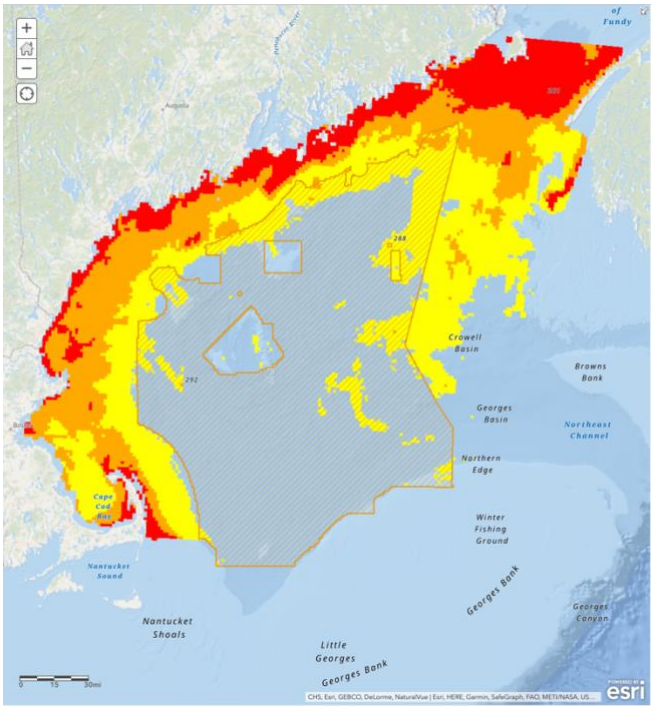
**Maine Threatened*
***ESA & Maine Endangered*

Areas of high abundance in the Gulf of Maine for seabirds that use the Northeast for breeding

Colored pixels show percentile thresholds of high seabird abundance:

- 50th percentile
- 75th percentile
- 90th percentile





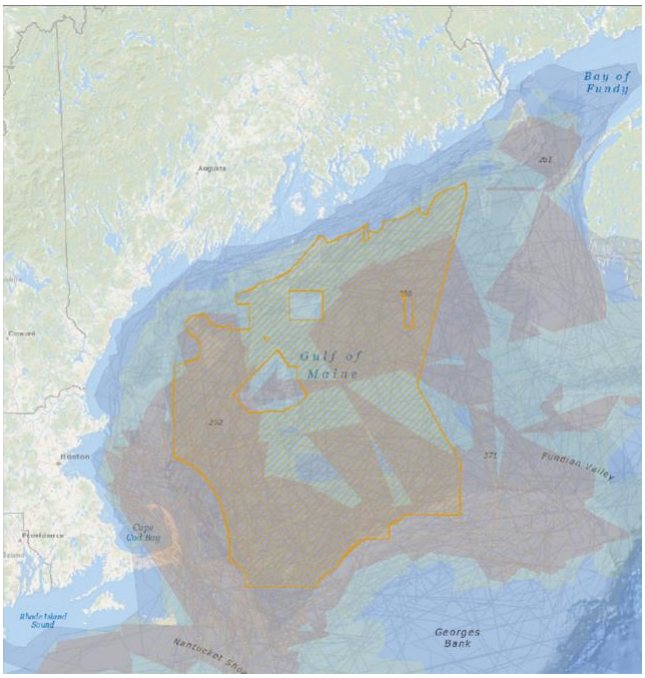
Great shearwater foraging in the Gulf of Maine

Seabird tracking data from the last 10 years show that great shearwaters heavily use the northern edge of George's Bank, Great South Channel, Stellwagen Bank and the Cape Cod slope for foraging between May and November each year (Powers et al. 2020; Powers pers. comm).

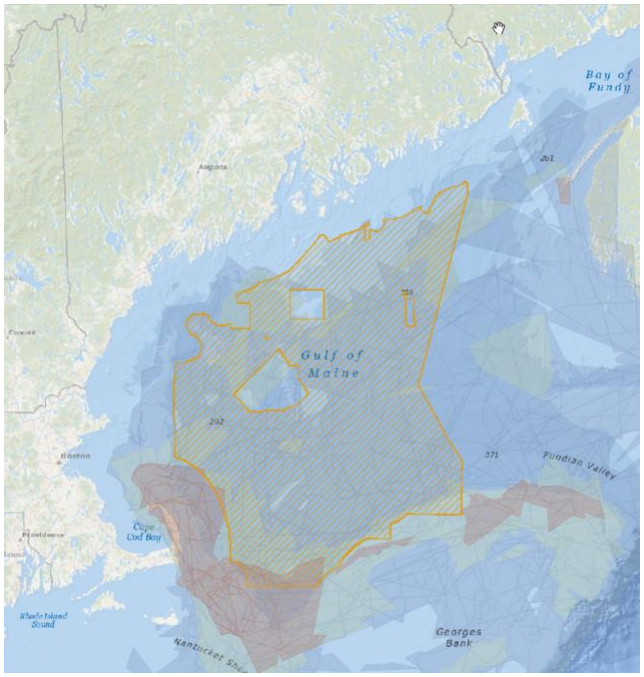
Utilization distributions with kernel density groupings:

- < 25%
- 25-50%
- 50%-95%

2013-2018



2019-2022 (no 2020)



Seabirds

**Maine Threatened*
***ESA & Maine Endangered*

Total Relative Abundance

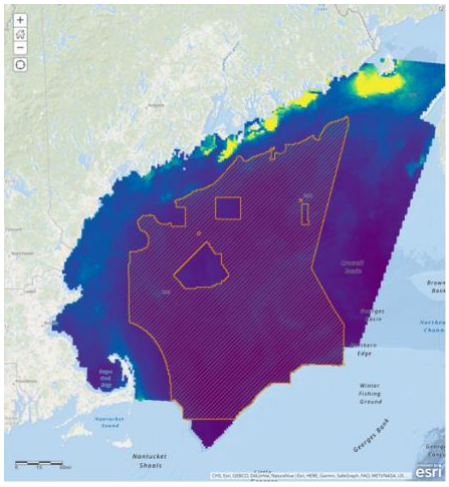
Areas of High Abundance in the Gulf of Maine

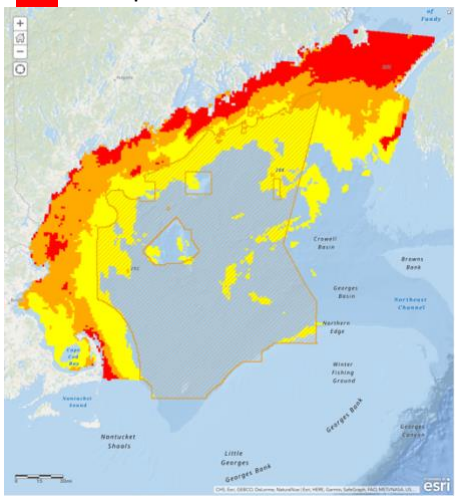
Colored pixels show percentile thresholds of high seabird abundance:

- 50th percentile
- 75th percentile
- 90th percentile

Species in the Gulf of Maine that are Northeast residents

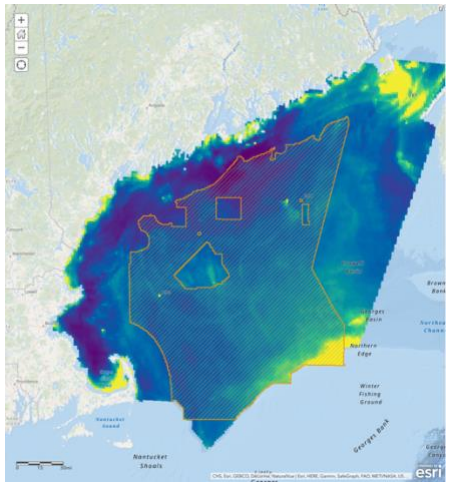
- Atlantic puffin*
- Black guillemot
- Brown pelican
- Double crested-cormorant
- Great black-backed gull
- Herring gull
- Laughing gull
- Razorbill*

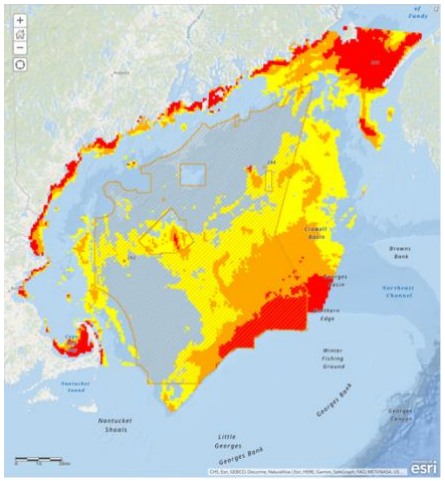




Species in the Gulf of Maine that use the Northeast for feeding

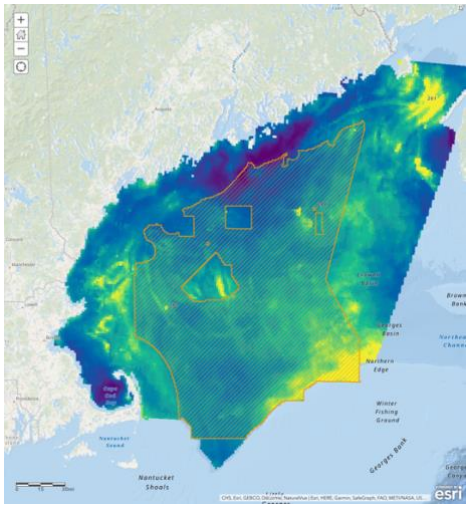
Audubon's shearwater; Band-rumped storm-petrel; Black scoter; Black-capped petrel; Black-legged kittiwake; Bonaparte's gull; Brown pelican; Common murre; Cory's shearwater; Dovekie; Great shearwater; Great skua; Horned grebe; Long-tailed duck; Manx shearwater; Northern fulmar; Northern gannet; Parasitic jaeger; Pomarine jaeger; Red phalarope; Red-breasted merganser; Red-necked phalarope; Red-throated loon; Ring-billed gull; Sooty shearwater; Sooty tern; South polar skua; Surf scoter; Thick-billed murre; White-winged scoter; Wilson's storm-petrel

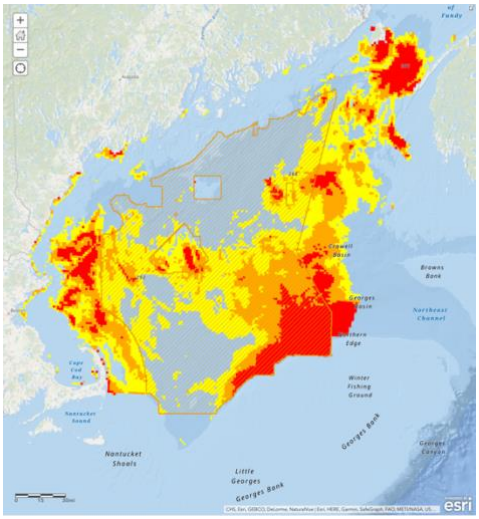




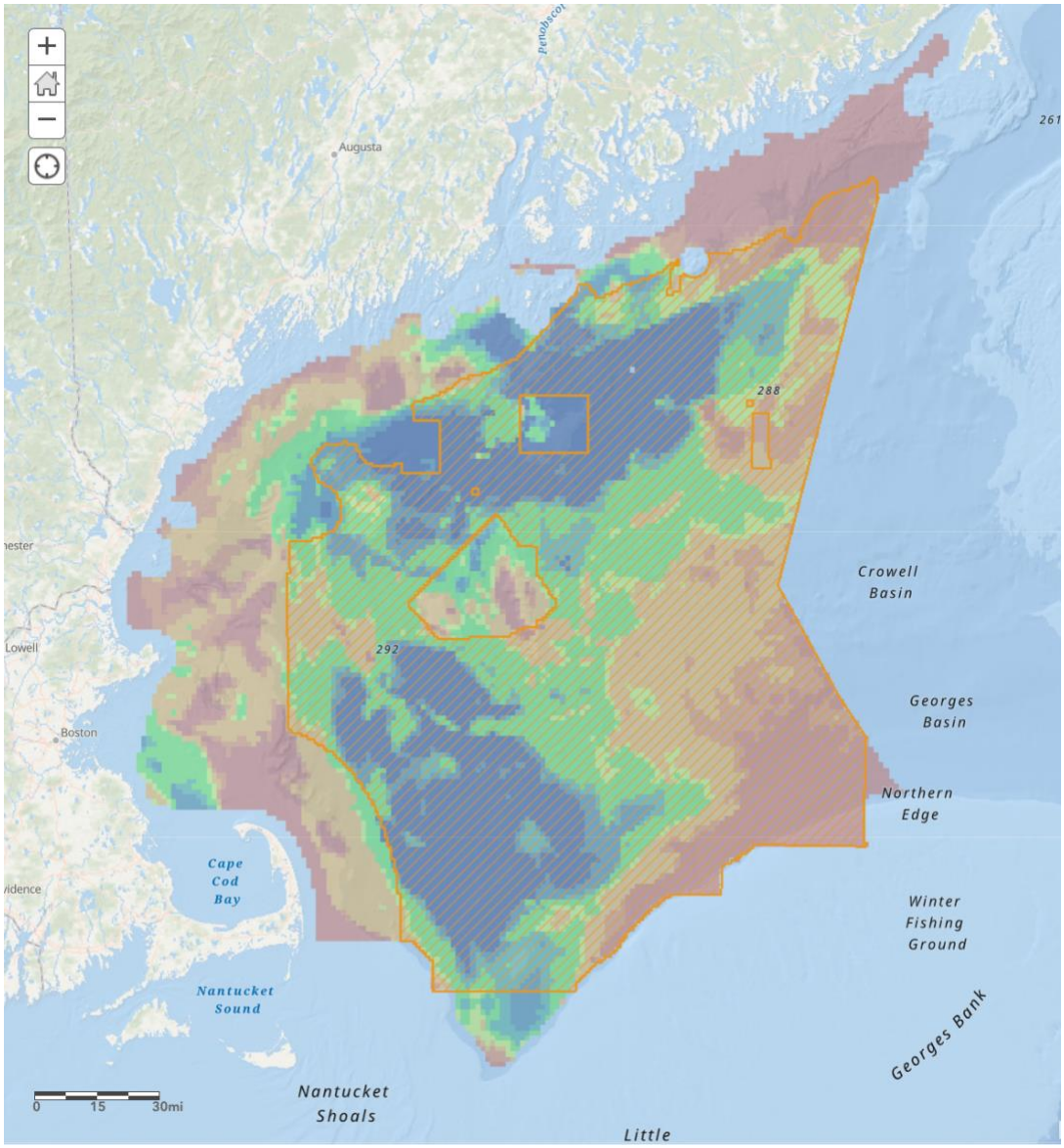
Species in the Gulf of Maine that are surface-feeders

Band-rumped storm-petrel; Black-capped petrel; Black-legged kittiwake; Bonaparte's gull; Great black-backed gull; Herring gull; Laughing gull; Leach's storm-petrel; Northern fulmar; Parasitic jaeger; Red phalarope; Red-necked phalarope; Ring-billed gull; Sooty tern; South polar skua; Wilson's storm-petrel





Seabird weighted density analysis of population vulnerability (PV), displacement vulnerability (DV), and collision vulnerability (CV) for all marine bird species built using MDAT models. Areas in blue indicate lower density of vulnerable species and areas in red indicate higher density of vulnerable species. Areas of the highest density of the most vulnerable species correspond with nearshore areas and shoals and banks including Cashes Ledge, Platts Bank, and the northern edge of Georges Bank.



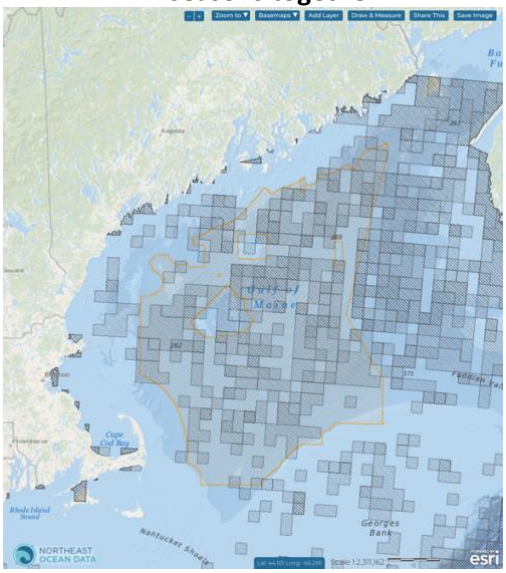
PV, DV, DV score totals

- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12

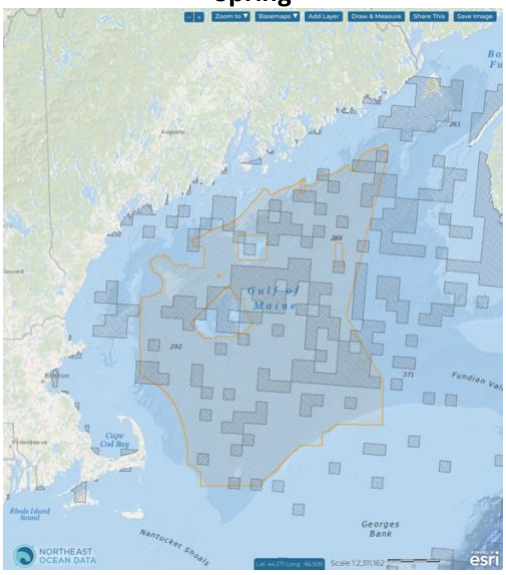
Seabird model uncertainty

- Corresponds to the seabird model outputs on Map pages 8 & 10
- For shaded grid cells for each season where no survey effort occurred (1978-2016), model outputs should be interpreted with caution
- Does not reflect the age of survey data; for example, open grid cells may contain survey data that are many decades old
- Areas overlapping with the Draft Call Area are poorly sampled in spring and winter

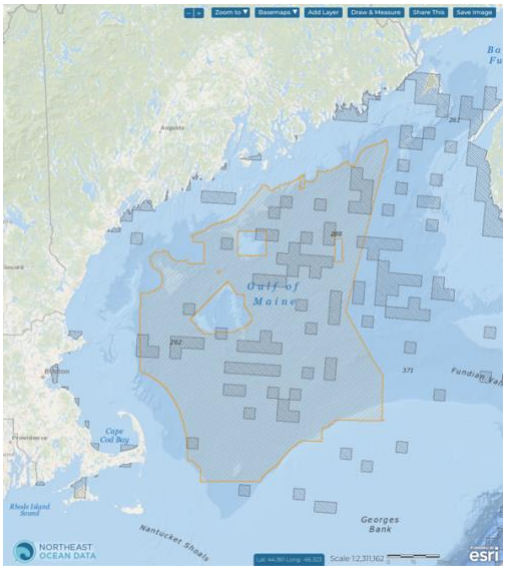
All seasons together



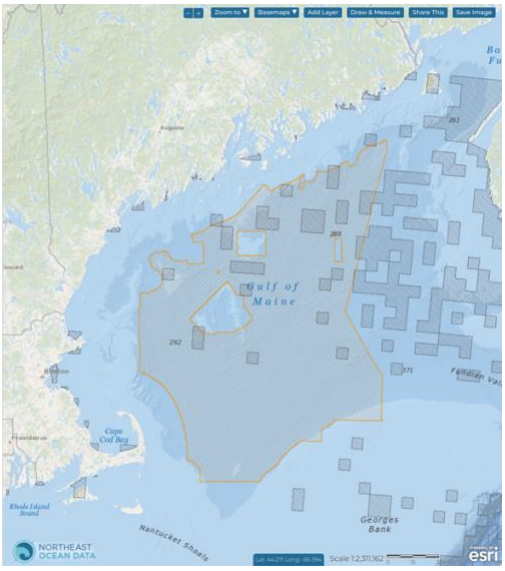
Spring



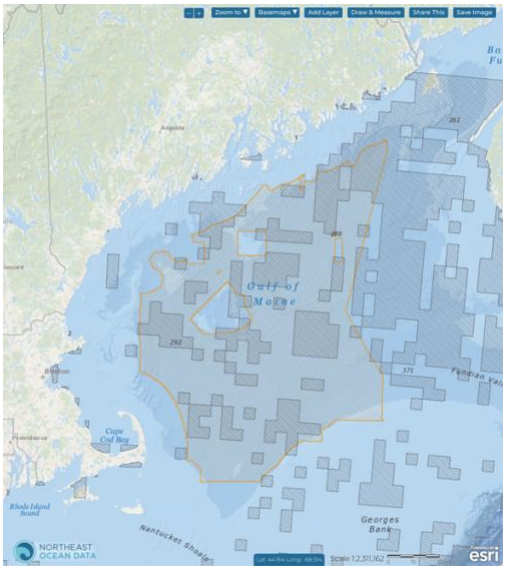
Summer



Fall



Winter



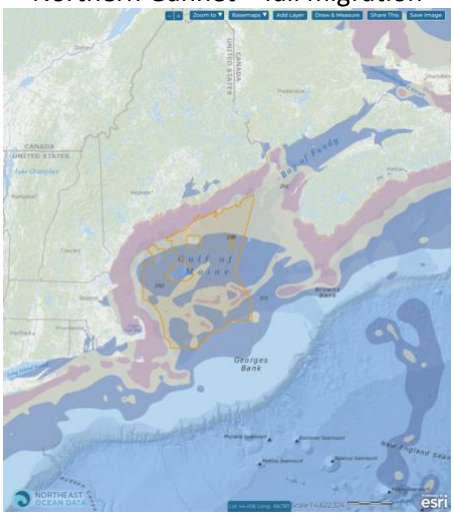
Diving bird movement patterns

50% - Core use areas
75%
95% - Mean home range

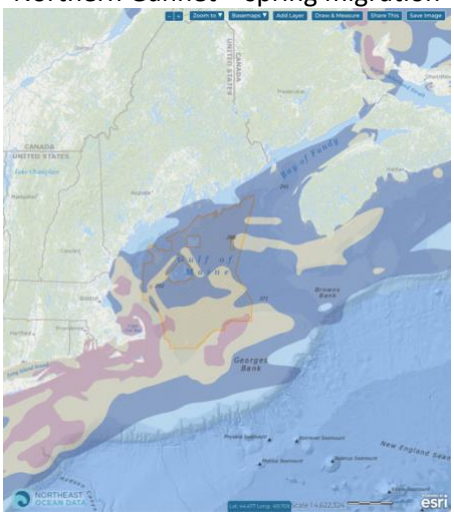
Notes:

- *Spiegel et al. 2017. Determining fine-scale use and movement patterns of diving bird species in Federal waters of the Mid-Atlantic United States using satellite telemetry. OCS Study BOEM 2017-069*
- *Winter utilization distributions do not overlap with Draft Call Area.*

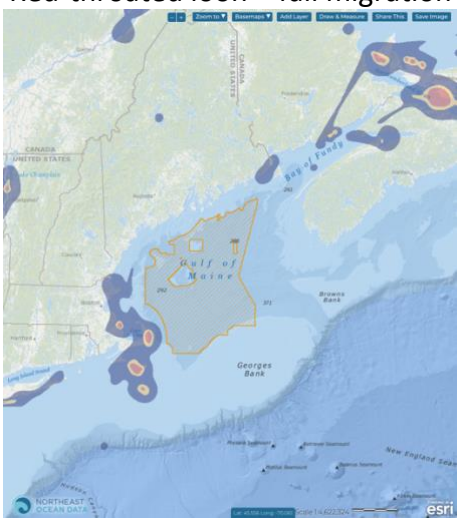
Northern Gannet – fall migration



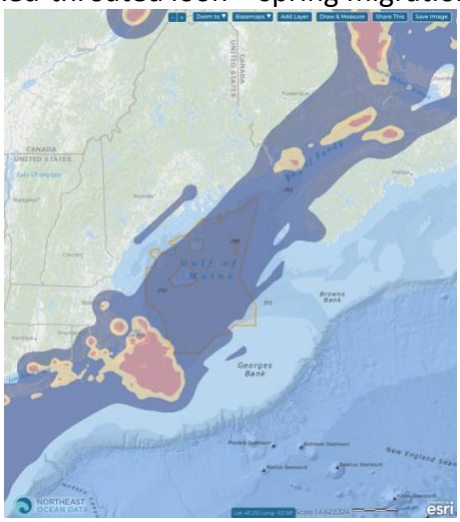
Northern Gannet – spring migration



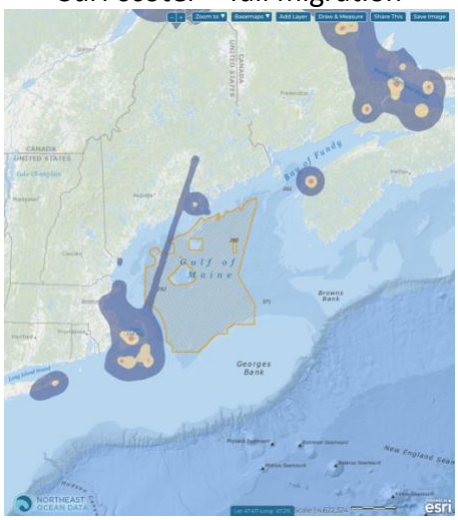
Red-throated loon – fall migration



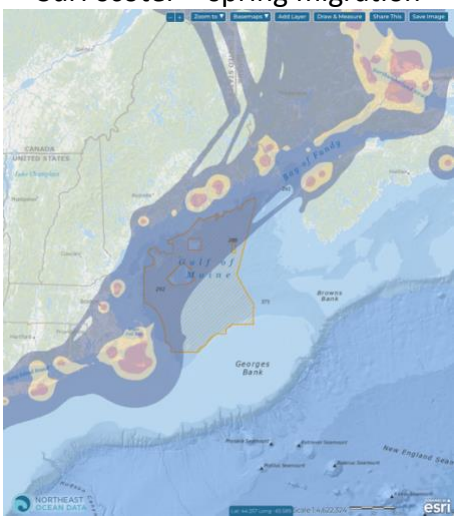
Red-throated loon – spring migration



Surf scoter – fall migration



Surf scoter – spring migration



Demersal Fish Species

- Acadian redfish
- American plaice
- Atlantic cod
- Atlantic halibut
- Barndoor skate
- Black sea bass
- Clearnose skate
- Cunner
- Fourspot flounder
- Goosefish
- Haddock
- Little skate
- Longhorn sculpin
- Ocean pout
- Offshore hake
- Pollock
- Red hake
- Rosette skate
- Scup
- Sea raven
- Silver hake
- Spotted hake
- Smooth skate
- Summer flounder
- Tautog
- Thorny skate
- White hake
- Windowpane flounder
- Winter flounder
- Witch flounder
- Yellowtail flounder

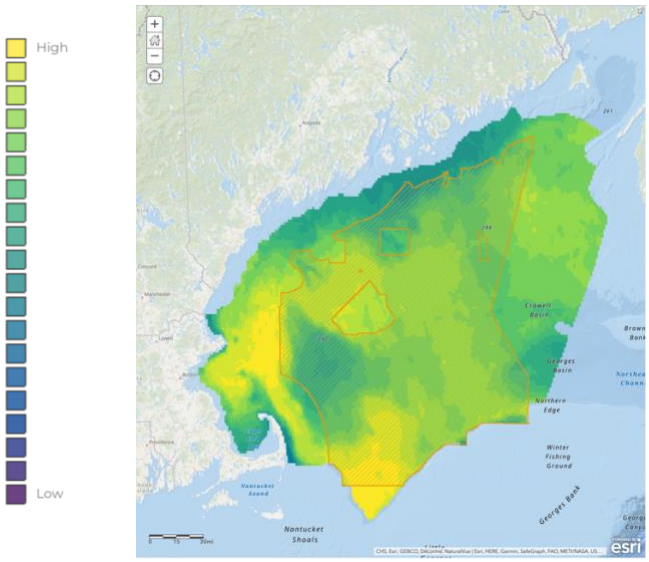
Areas of High Biomass in the Gulf of Maine

Colored pixels show percentile thresholds of high fish biomass:

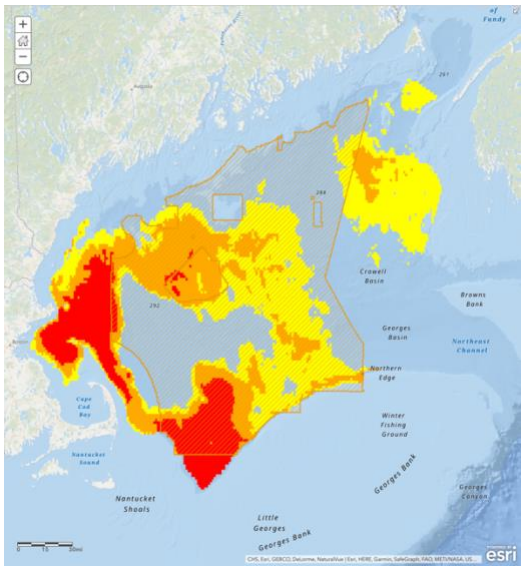
- 50th percentile
- 75th percentile
- 90th percentile

Total Biomass (NMFS trawl) 2010-2019

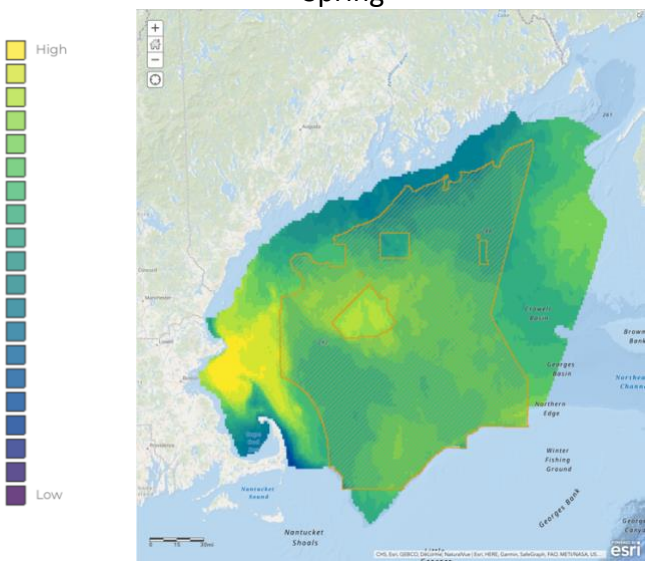
Fall



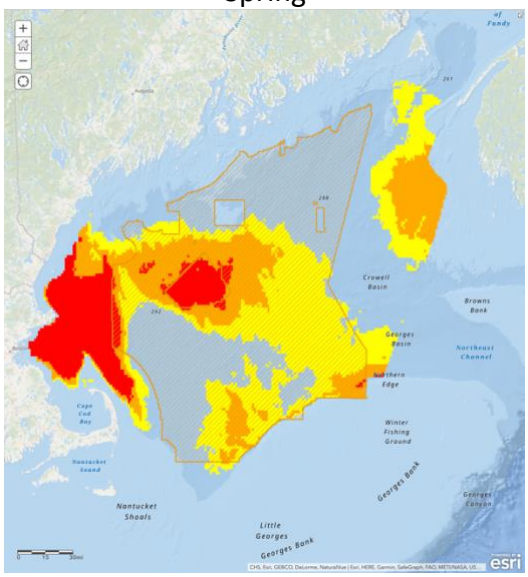
Fall



Spring



Spring



Forage Fish Species

- Alewife
- Sand lance
- American shad
- Atlantic herring
- Atlantic mackerel
- Atlantic menhaden
- Bay anchovy
- Blueback herring
- Butterfish
- Hickory shad
- Round herring
- Striped anchovy

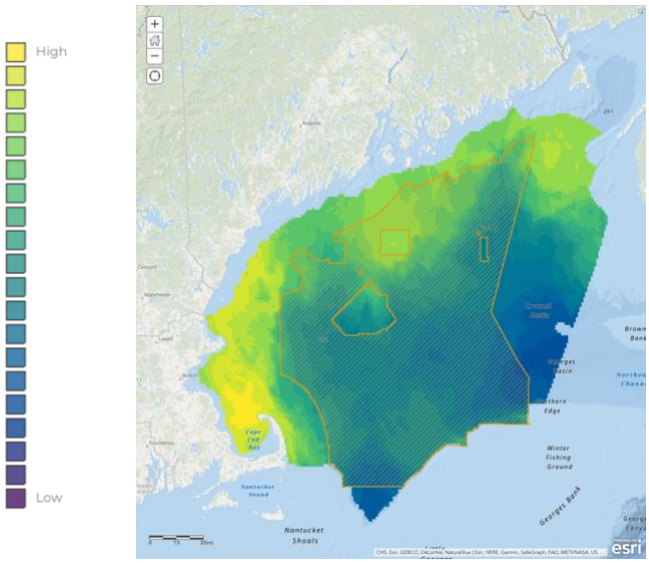
Areas of High Biomass in the Gulf of Maine

Colored pixels show percentile thresholds of high fish biomass:

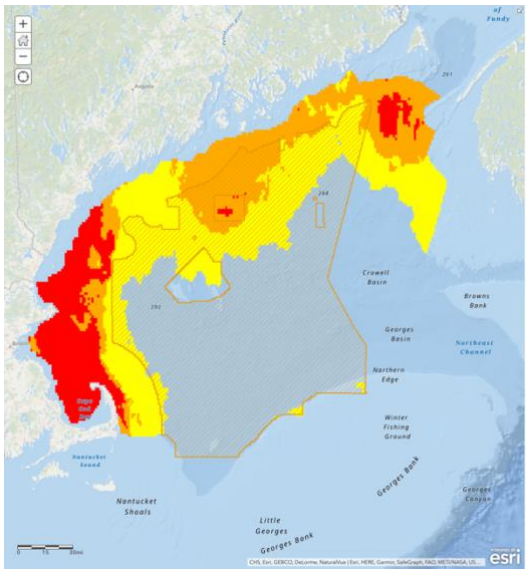
- 50th percentile
- 75th percentile
- 90th percentile

Total Biomass (NMFS trawl) 2010-2019

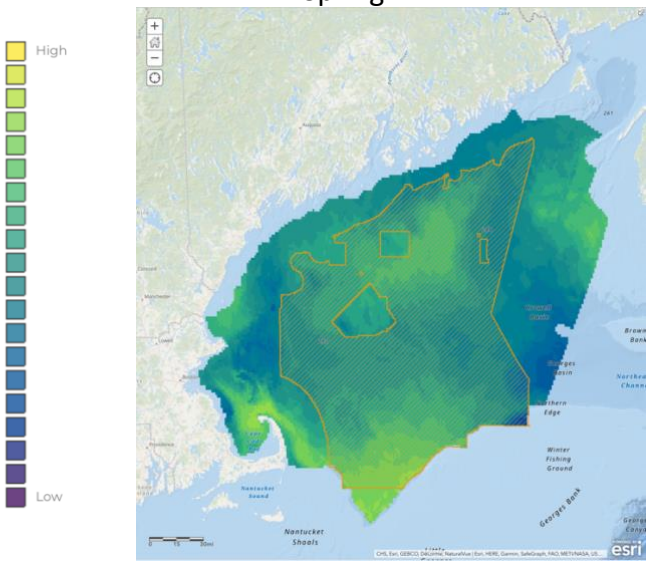
Fall



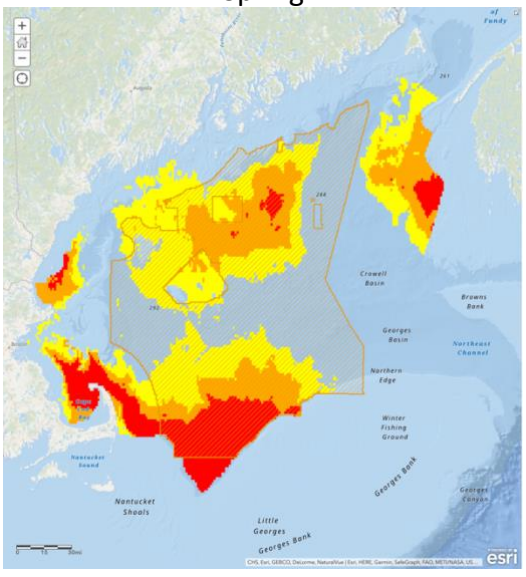
Fall



Spring



Spring



Deep sea coral habitat suitability

- Office for Coastal Management, 2023: Deep-sea Soft Coral Habitat Suitability, https://www.fisheries.noaa.gov/inport/item/48877
- Office for Coastal Management, 2023: Deep-sea Stony Coral Habitat Suitability, https://www.fisheries.noaa.gov/inport/item/48878